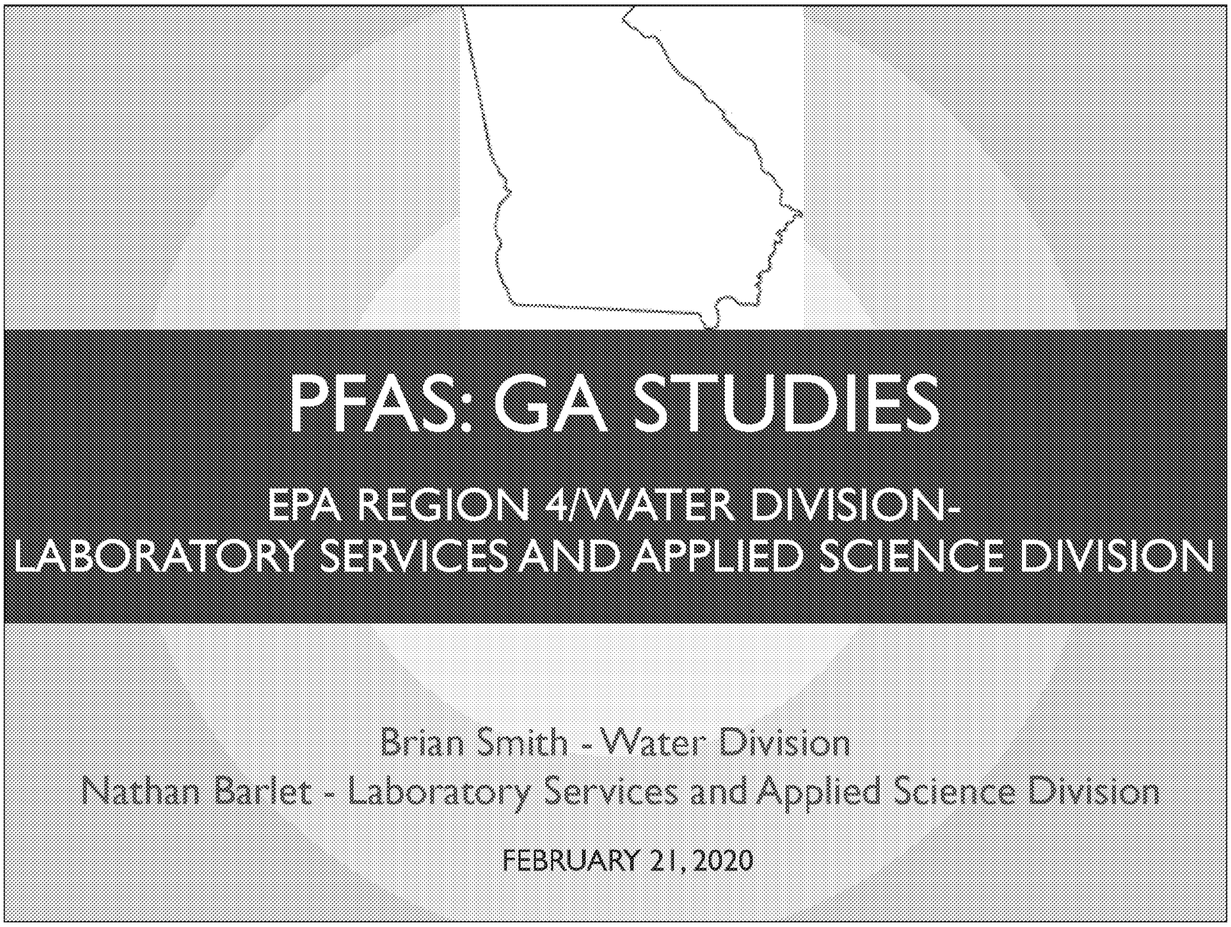

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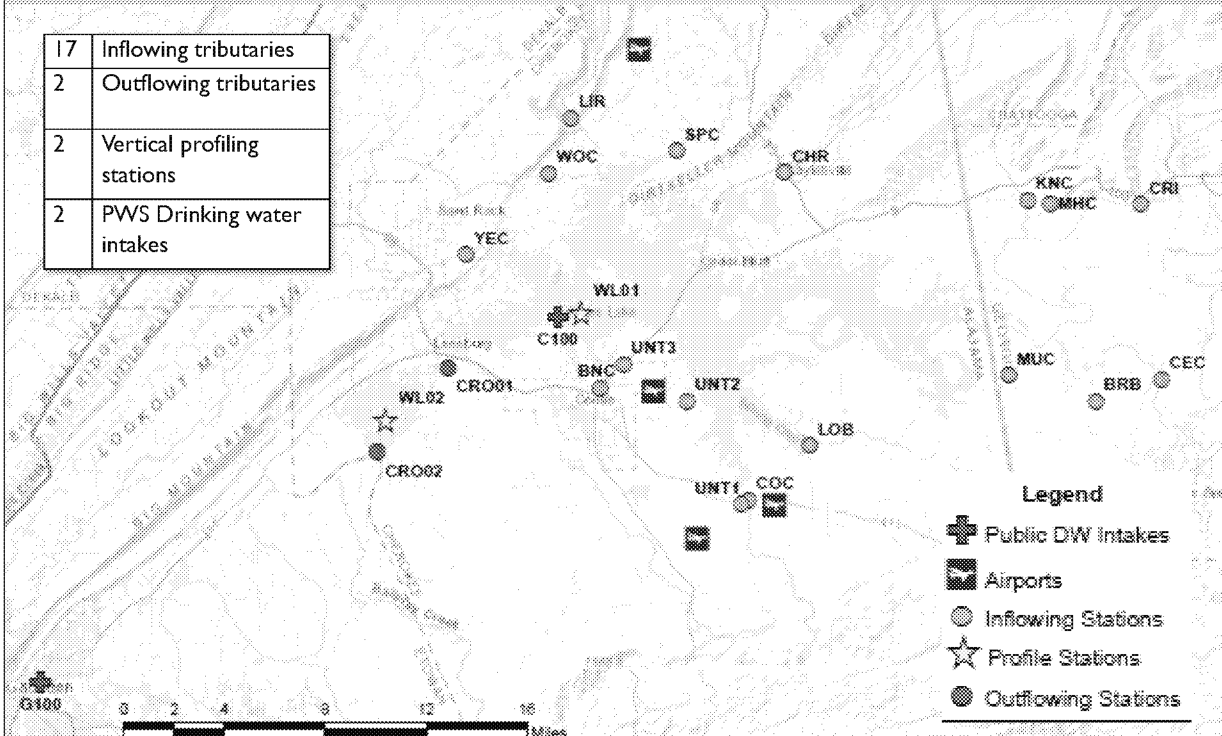
PRIORITIZATION OF PFAS CONTRIBUTIONS TO WEISS LAKE

Study Objectives:

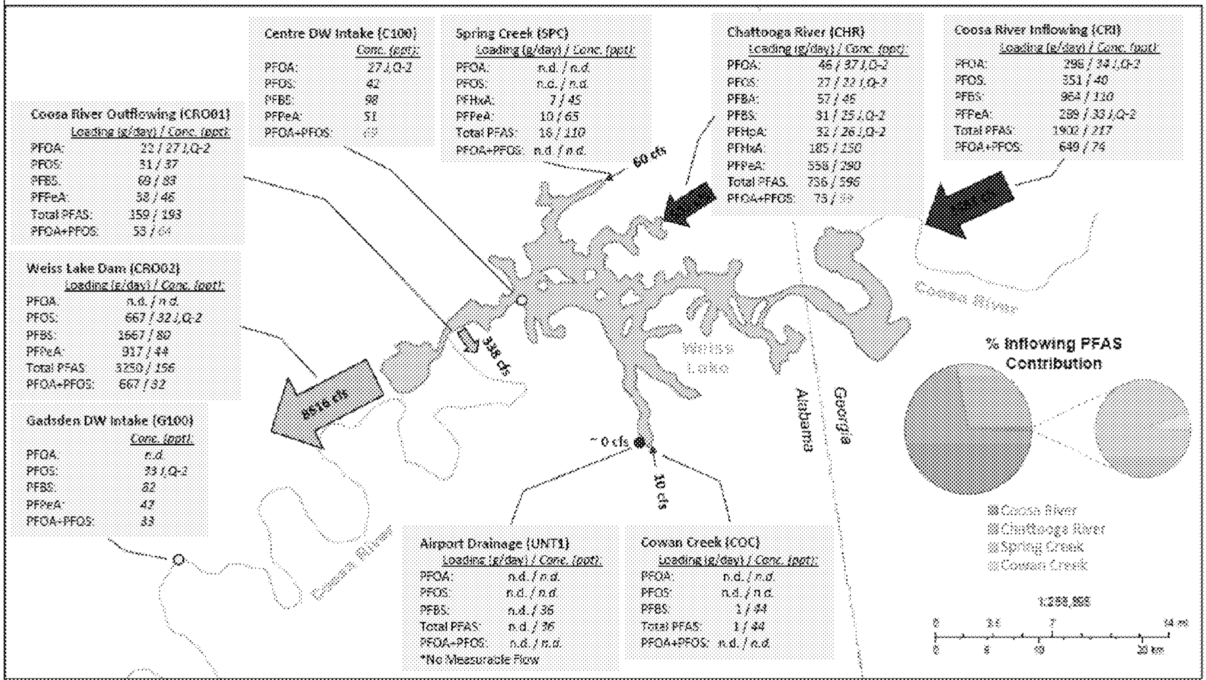
1. Measure background PFAS concentrations and streamflow measurements for all inflowing and outflowing tributary station of Weiss Lake.
2. Estimate mass loading rates of PFASs into Weiss Lake.
3. Examine vertical distribution of PFASs within the lake water column and understand the correlation with water quality parameters.

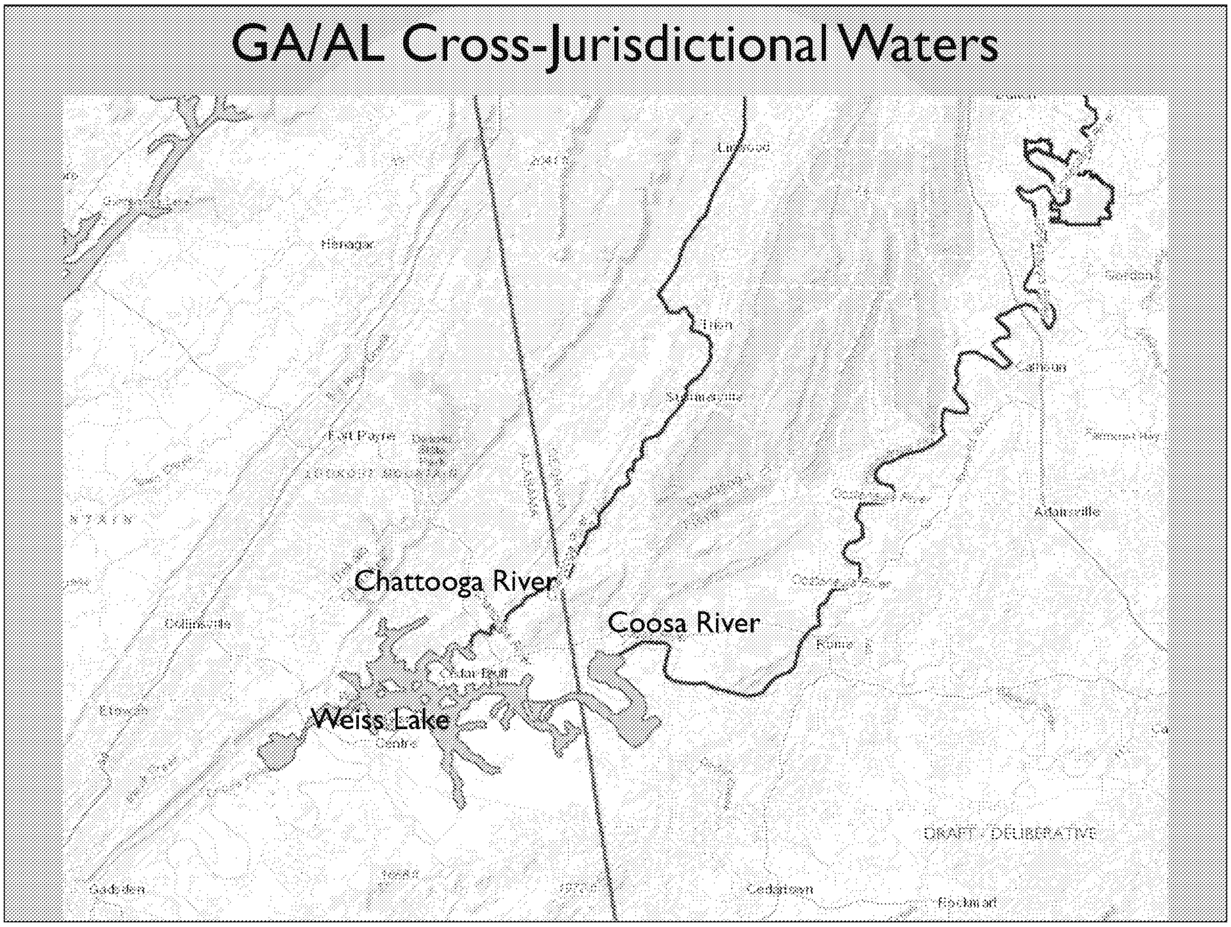
Study: Prioritization of PFAS inputs into Lake Weiss

17	Inflowing tributaries
2	Outflowing tributaries
2	Vertical profiling stations
2	PWS Drinking water intakes



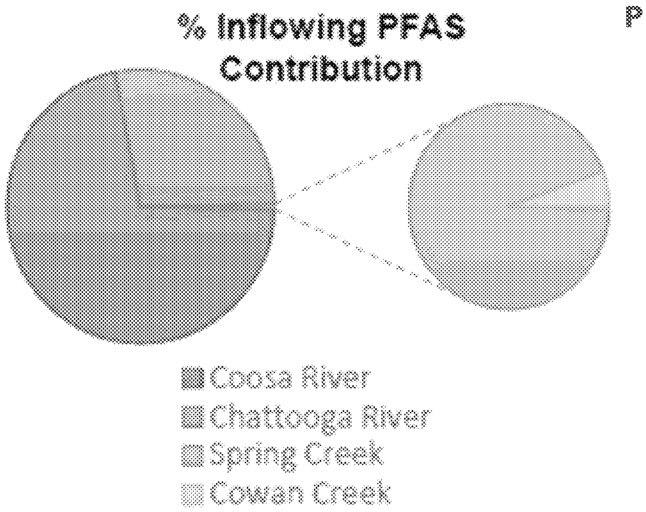
Results: Prioritization of PFAS inputs into Lake Weiss

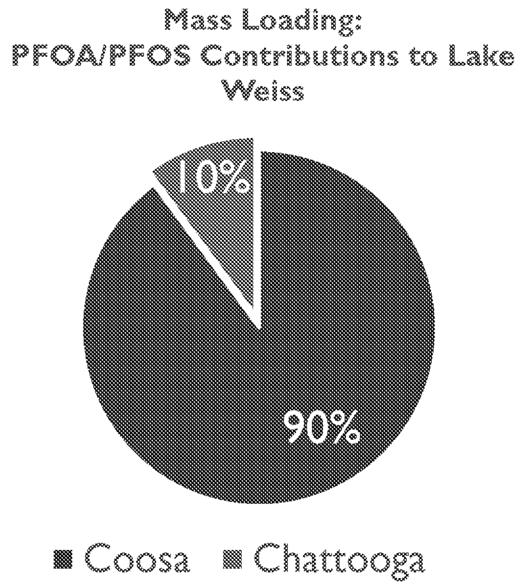




13 co-located SW and sediment samples from LaFayette through Weiss Lake

PFAS CONTRIBUTION





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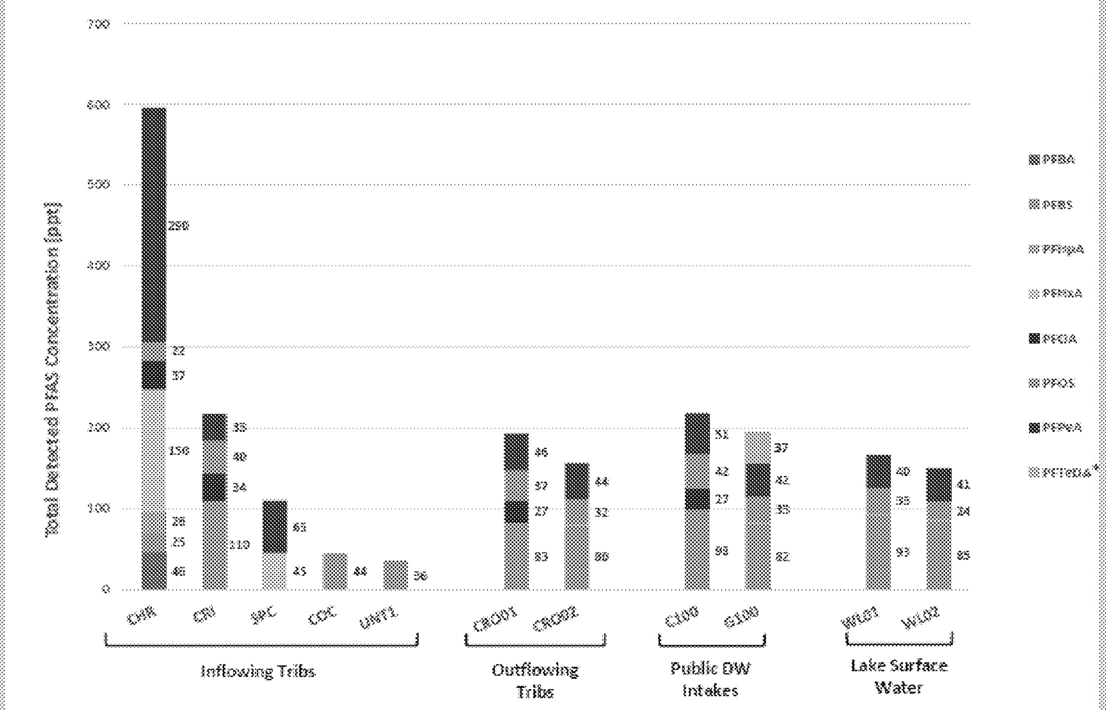
Composition of PFAS



* PFTeDA was detected in a duplicate sample collected at G100. This value is an estimate and should be limited to screening purposes only.

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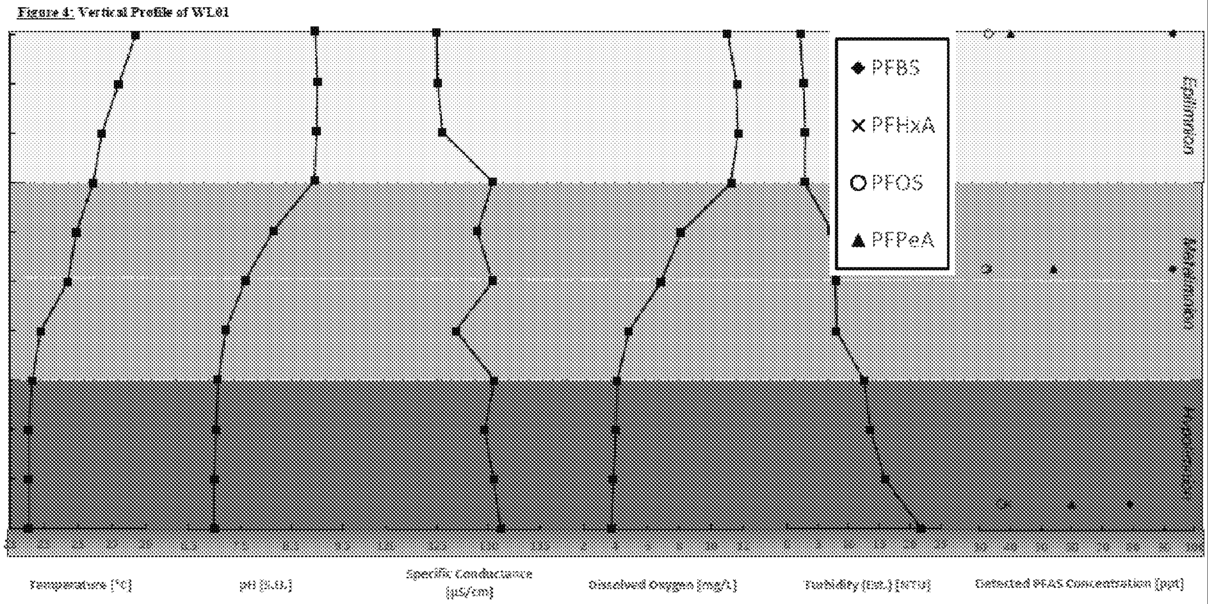
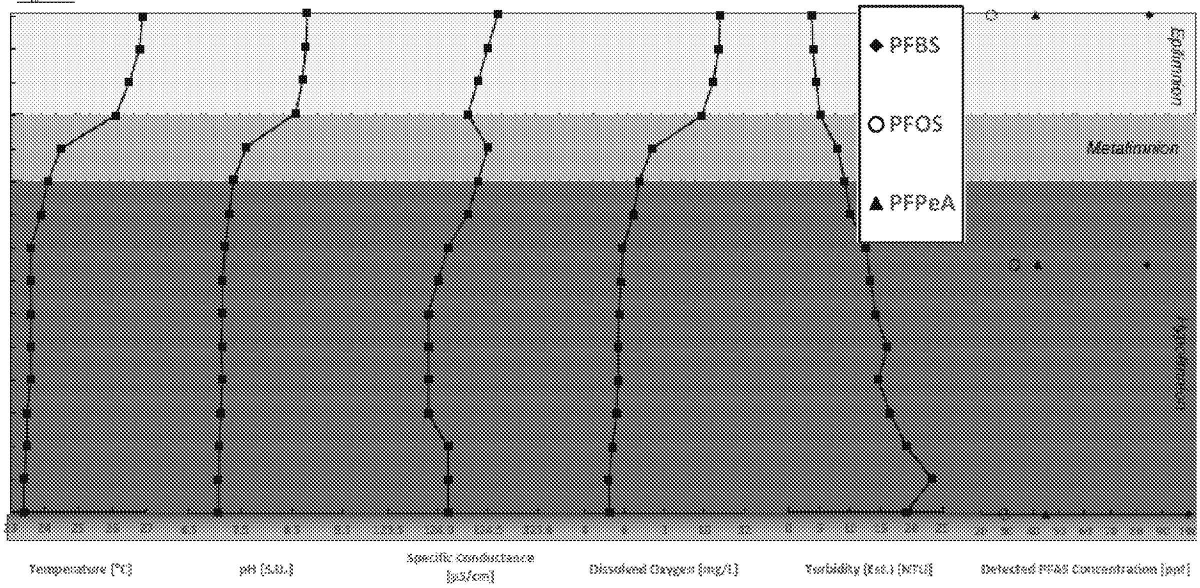
VERTICAL PROFILE – WL01



VERTICAL PROFILE – WL02

Figure 6: Vertical Profile of WL02



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PRIORITIZATION OF PFAS CONTRIBUTIONS TO WEISS LAKE

Conclusions:

- Coosa River inlet sample
    - 74 ppt (combined PFOA/PFOS)
    - Largest mass loading rate - 7x flow from Chattooga
    - 90% of combined PFOA/PFOS; 72% of total PFAS
- Chattooga River inlet sample
    - 59 ppt (combined PFOA/PFOS)
    - Greater diversity of PFASs and largest total PFAS concentration
- Consistent distribution of 3 PFASs (PFOS, PFPeA, PFBS) vertically (up to 30 feet below surface) throughout a thermally stratified water column.
    - PFAS contributions from surface water and sediment samples
- Most prevalent PFASs: PFPeA and PFBS (short-chain compounds)

Question: Can we use the LHA as reference to surface water PFOA/PFOS?

UPPER COOSA RIVER BASIN

September 2019

In the past, LAS considered no discharge permit. No NPDES outfall. Even though they monitor for contaminants in the river and have limits. It's a state facility.

Dalton Utilities LAS Carpet company overapplying spraying to a creek which ended up in the river. 10 yrs ago. Unsure if a consent decree came out of it.

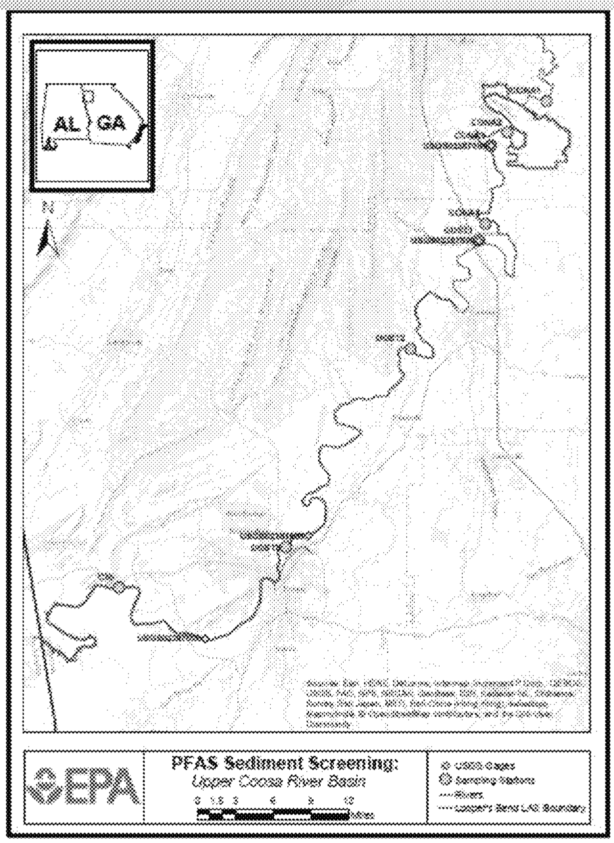
ASSESSMENT OF RESUSPENDED SEDIMENTS AS A SOURCE OF PFAS TO THE UPPER COOSA RIVER BASIN

Conasauga, Oostanaula and Coosa Rivers

Study Objectives:

1. Measure PFAS concentration and composition in stream sediments impacted by the Looper's Bend LAS along the Conasauga into the receiving waters of the Oostanaula and Coosa Rivers.
2. Compare PFAS concentration and composition in co-located surface water and sediment samples.
3. Estimate instantaneous suspended sediment flux to determine the downstream PFAS migration of sediments.

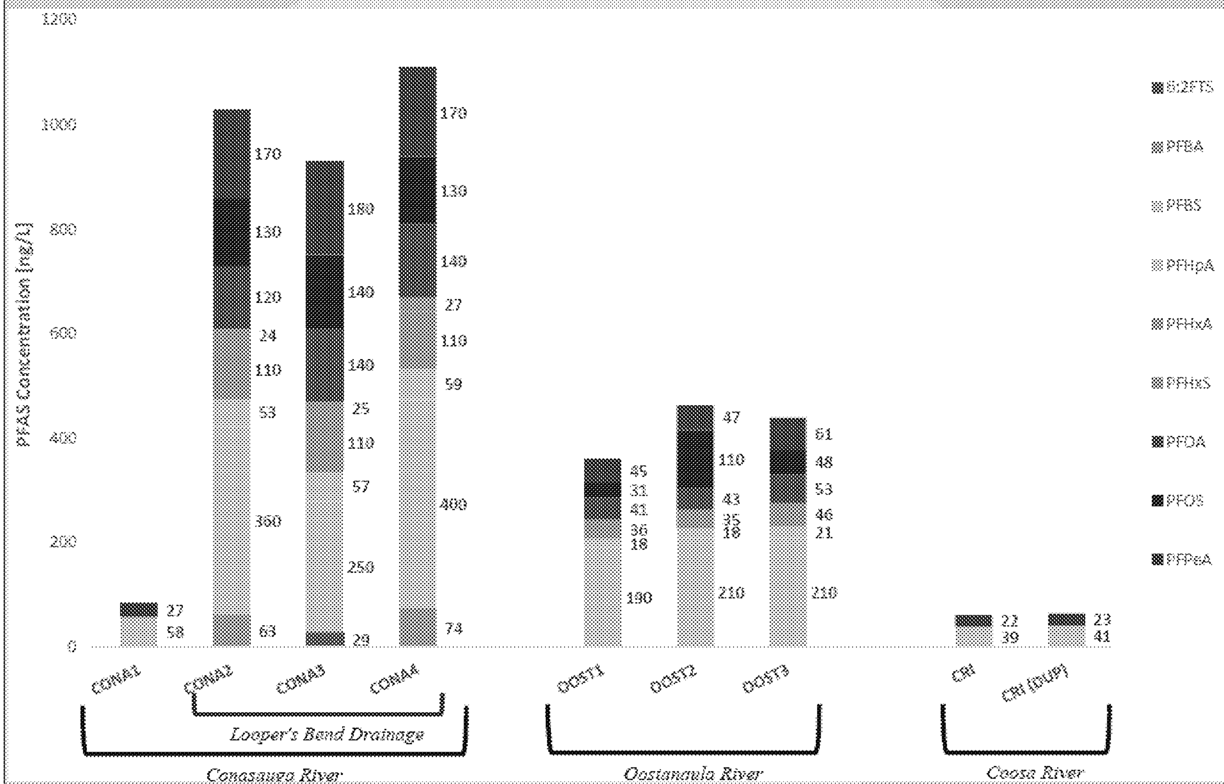
*Targeted base-flow conditions to avoid PFAS Inputs from surface water runoff and dilution



Total of 8 sites sampled for 25 PFAS Analytes:

- 8 sites co-located sediments and surface waters
  - TOC & TSS (sediment)
- 4 of the 8 surface water samples included the following additional analysis:
  - Filtration to determine fraction of PFAS suspended in water column
  - USGS Streamflow
  - TOC & TSS (surface water)

Composition of Detected PFAS – Surface Water



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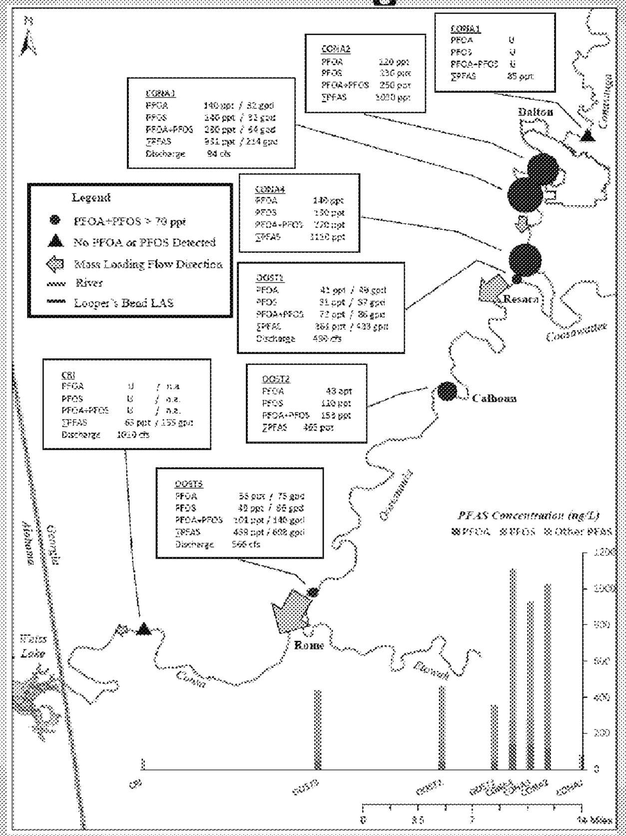
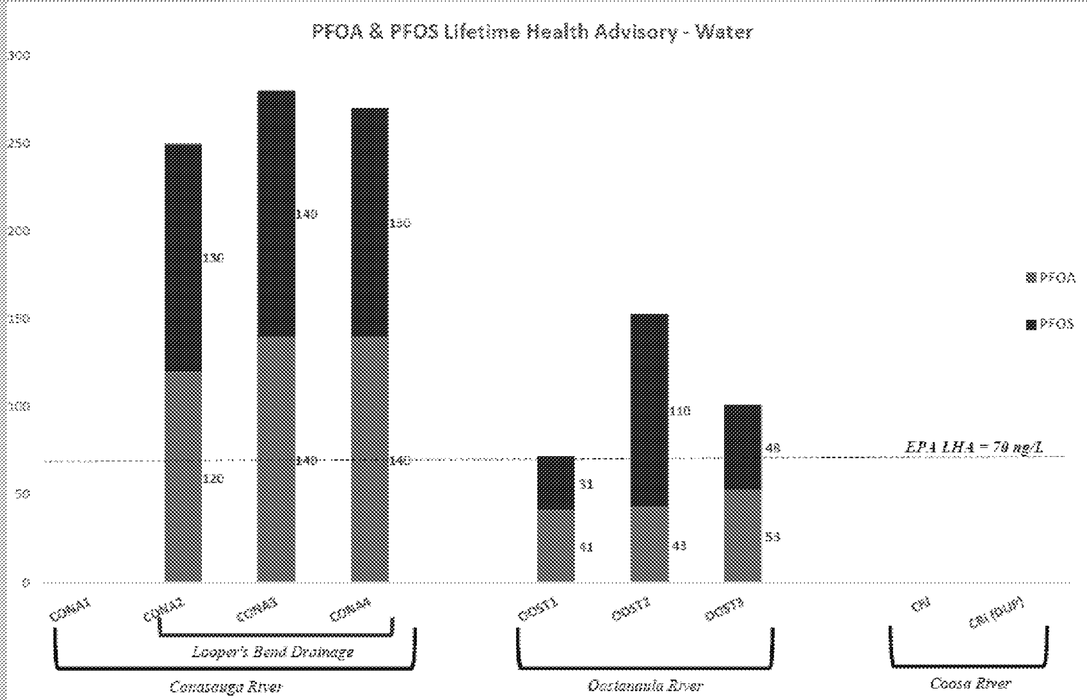
Distribution and Mass Loading of PFAS Surface Water

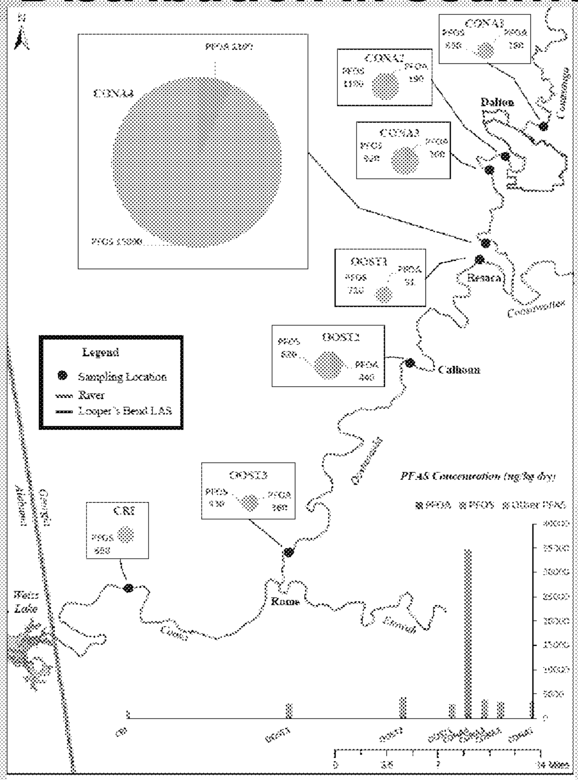


PFOA and PFOS in Surface Water



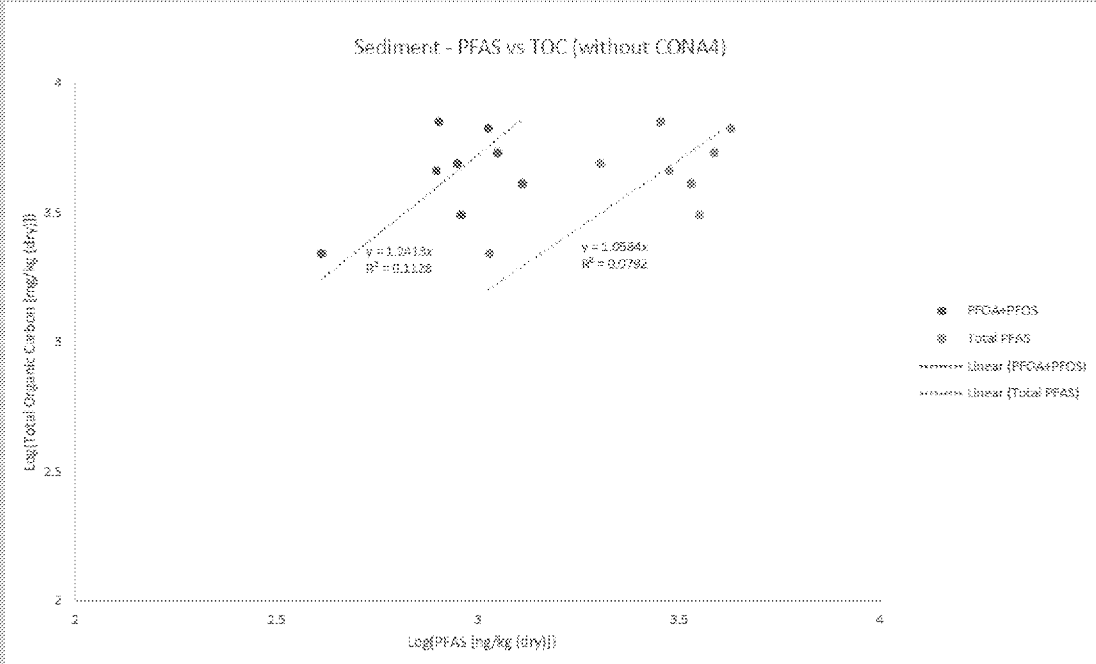
Combined PFOA and PFOS concentrations were approximately 3 times greater than the EPA's lifetime health advisory (LHA) of 70 ppt on the Conasauga River downstream of Looper's Bend LAS with residual concentrations detected at or above the LHA on the Oostanaula River.

PFAS Distribution in Sediments



All PFAS concentrations are in ng/kg *dry* (ppt). Pie charts are shown in relative proportions based on combined PFOA and PFOS.

TOC and PFAS Retention



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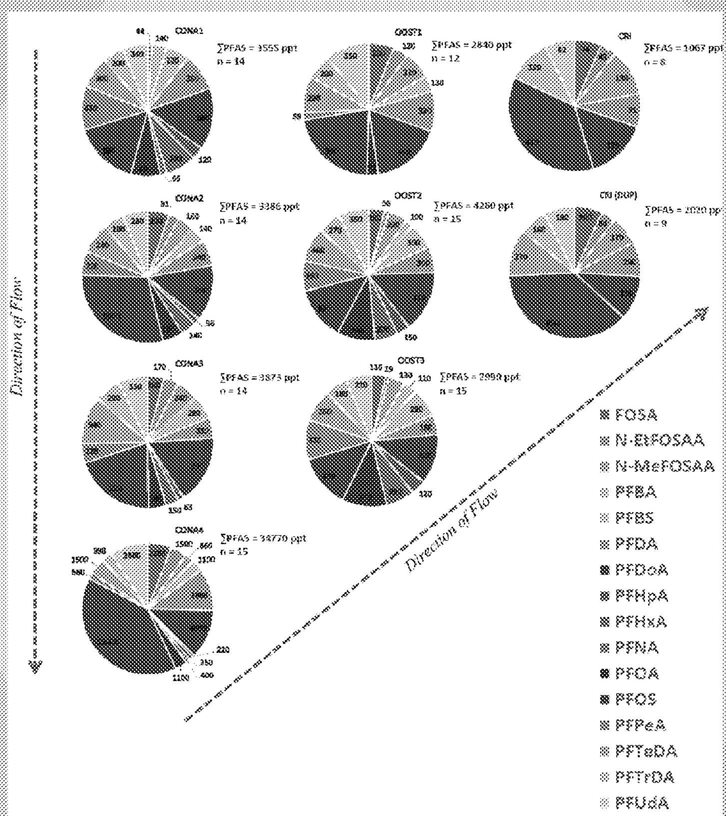
Functional Group and Classification

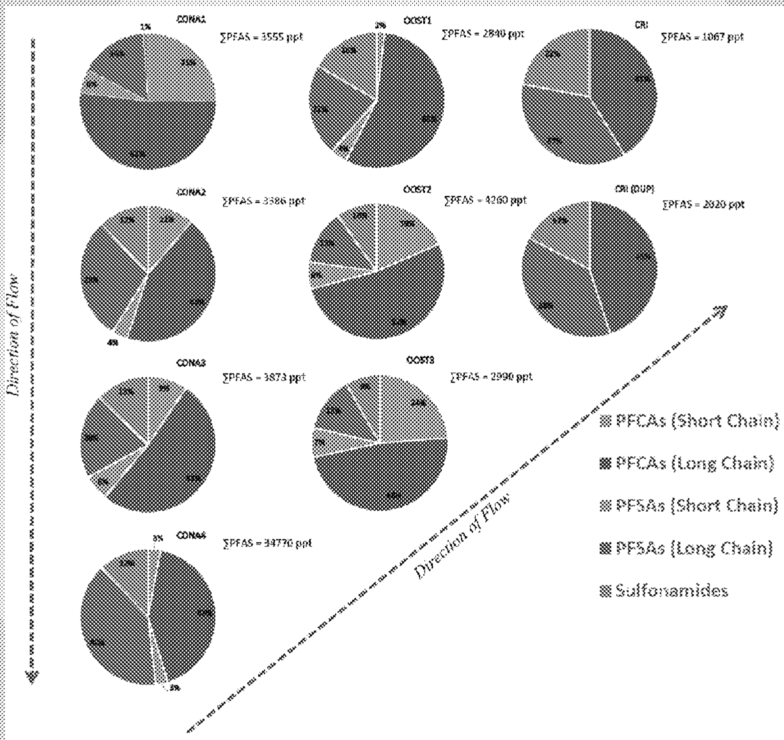
Carbon Chain Length	PFAS Analyte	Class	Functional Group
14	PFTeDA	Long Chain	PFCAs
13	PFTrDA		
12	PFDoA		
11	PFUDA		
10	PFDA		
9	PFNA		
8	PFOA		
7	PFHpA	Short Chain	
6	PFHxA		
5	PFPeA		
4	PFBA		
10	PFDS	Long Chain	PFSAs
9	PFNS		
8	PFOS		
7	PFHpS		
6	PFHxS		
5	PFPeS	Short Chain	
4	PFBS		
10	8:2 FTS	Precursor	Fluorotelomers
8	6:2 FTS		
6	4:2 FTS		
10	N-EtFOSAA	Precursor	Sulfonamides
9	N-MeFOSAA		
8	FOSA		
6	HFPO-DA	GenX	Fluoropolyether

Classifications adapted from ITRC, 2018

Composition of Detected PFAS in Sediments

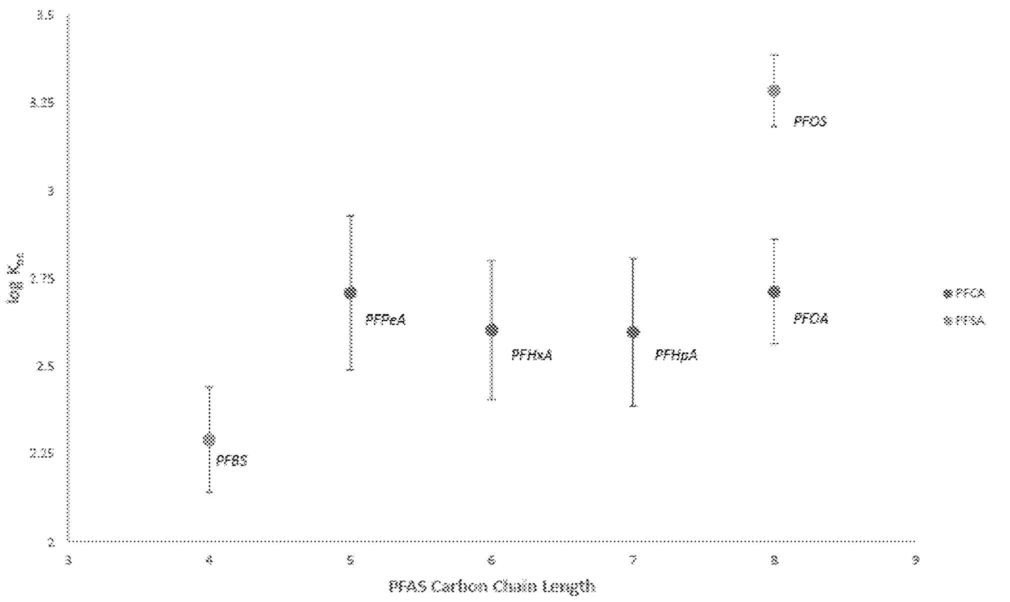


PFAS Class and Functional Group in Sediments



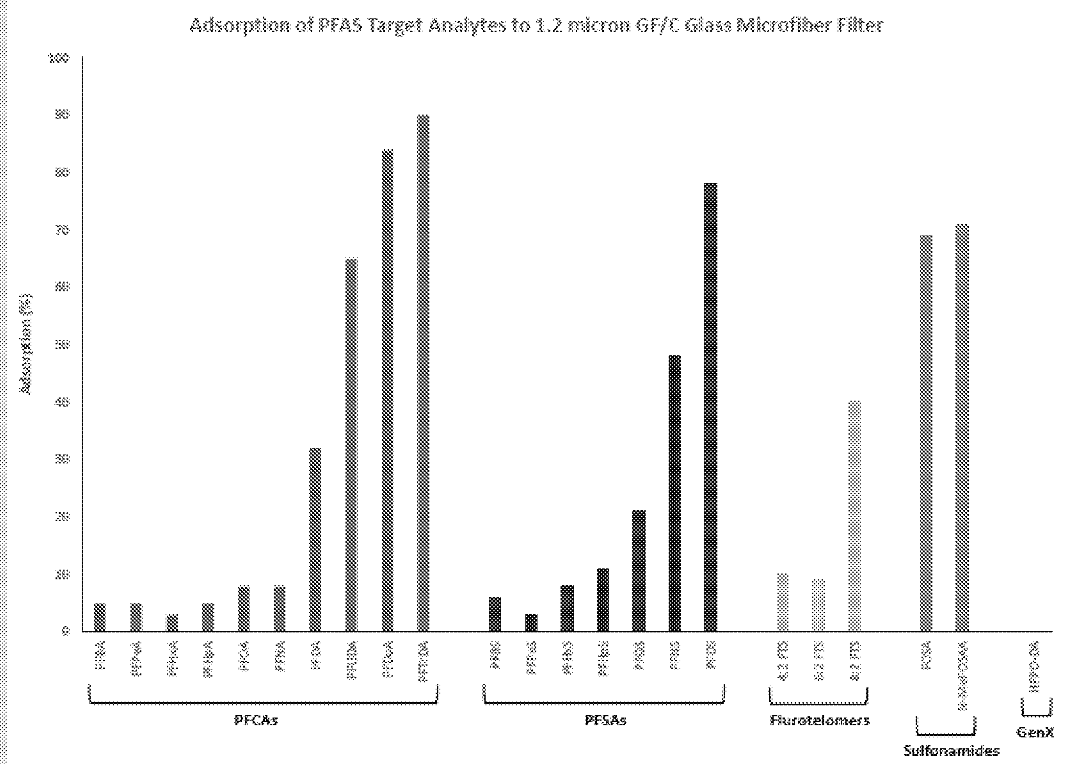
Sediments were predominately composed of long-chain PFAS. Sulfonamides were detected throughout the watershed which are known to be precursors to both PFOS and PFOA.

Organic Carbon on PFAS Retention in Sediments



The effect of organic carbon and the retention of PFAS in sediments is dependent on both the chain length and functional group. PFAS retention in sediments generally increases with increasing chain length and PFSAs (*e.g.* PFOS) are more likely to be retained compared to PFCAs (*e.g.* PFOA) of the same chain length.

PFAS Adsorption Capacity of Glass Filter



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UPPER COOSA RIVER BASIN: SURFACE WATER-SEDIMENTS

Conasauga, Oostanaula and Coosa Rivers

Conclusions:

- **Surface water**:
  - PFBS and PFPeA (short-chain compounds) are most prevalent throughout the watershed (similar to Prioritization Study)
  - Generally dominated by short-chain PFSAs and PFCAs (highly water-soluble)
- **Sediment:**
  - Dominated by long-chain PFCAs, followed by long-chain PFSAs and sulfonamido precursors (higher adsorption capacity)
  - Total PFAS influenced by the presence of TOC

UPPER COOSA RIVER BASIN: SURFACE WATER-SEDIMENTS

Conasauga, Oostanaula and Coosa Rivers

Conclusions:

- **Mass Loading:**
  - Conasauga River: 74% of PFOA/PFOS Mass Loading to the Oostanaula River
  - Mass loading analysis limited by current Method Detection Limit
- Highest diversity and concentrations of PFAS observed downstream of Looper's Bend persisting in the receiving waters
- The contribution of resuspended sediments was inconclusive due to high variability and adsorption loss of PFAS to filters

CHATTOOGA RIVER WATERSHED

November 2019

In the past, LAS considered no discharge permit. No NPDES outfall. Even though they monitor for contaminants in the river and have limits. It's a state facility.

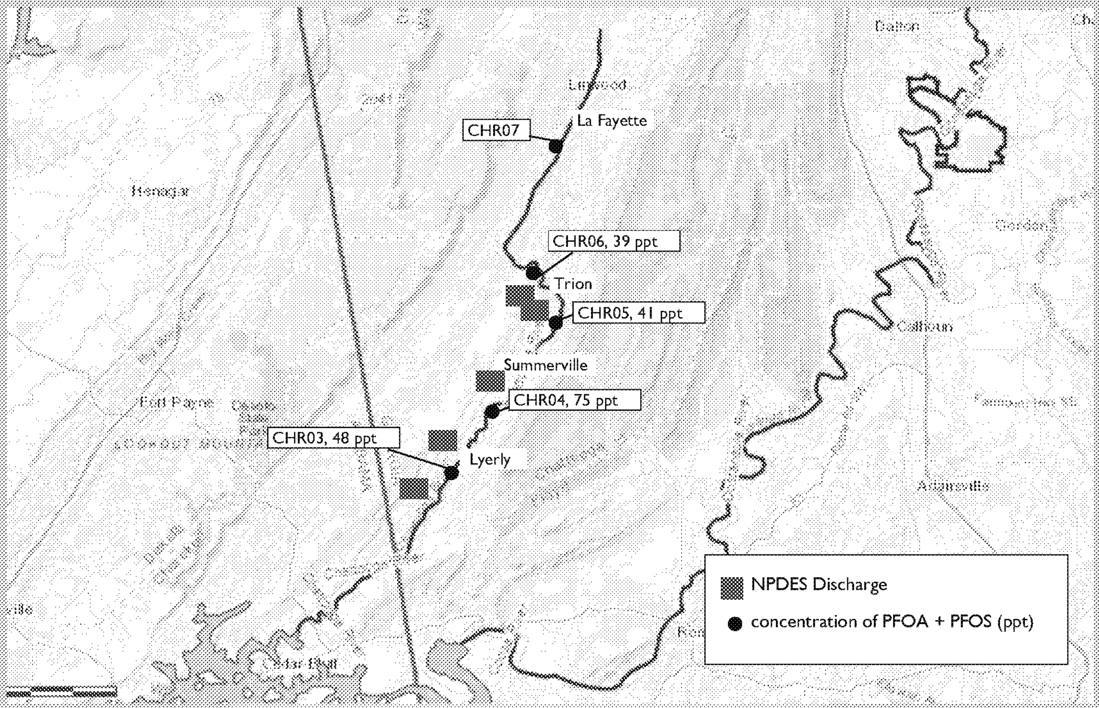
Dalton Utilities LAS Carpet company overapplying spraying to a creek which ended up in the river. 10 yrs ago. Unsure if a consent decree came out of it.

Characterization of Ambient PFAS in the Chattooga River Watershed

Study Objectives:

1. *Characterize the distribution and instantaneous mass loading of PFAS in the Chattooga River Watershed at near-base flow conditions along key segments determined by the R4 water division.*
2. Collect surface water samples coupled with discharge measurements to compute instantaneous mass loading rates of PFAS along key segments of the Chattooga River Watershed.
3. Collect sediment samples collocated with surface water sample locations to determine the relative distribution and the potential for migration of PFAS contaminated sediments to the receiving waters of

Sampling Locations – Key Segments



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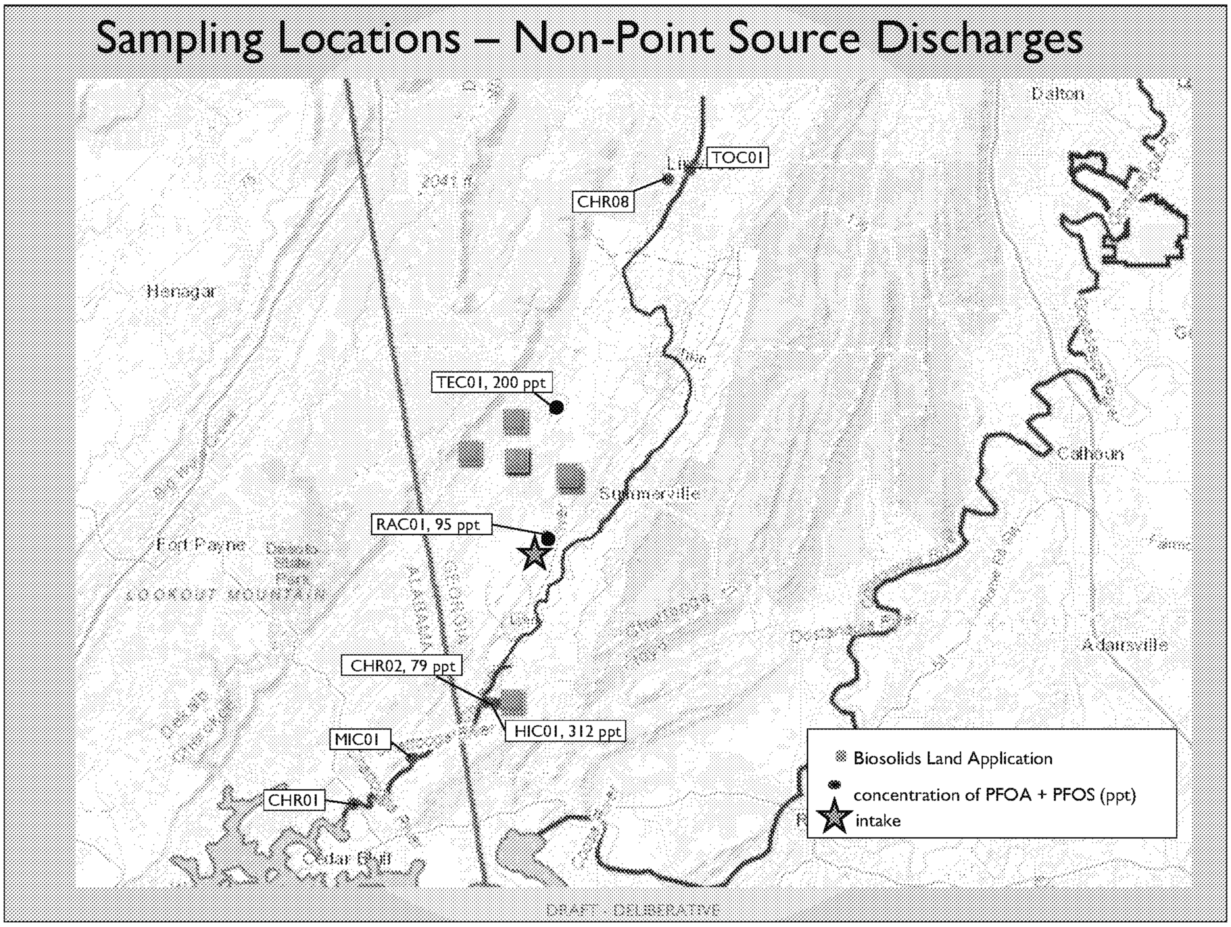
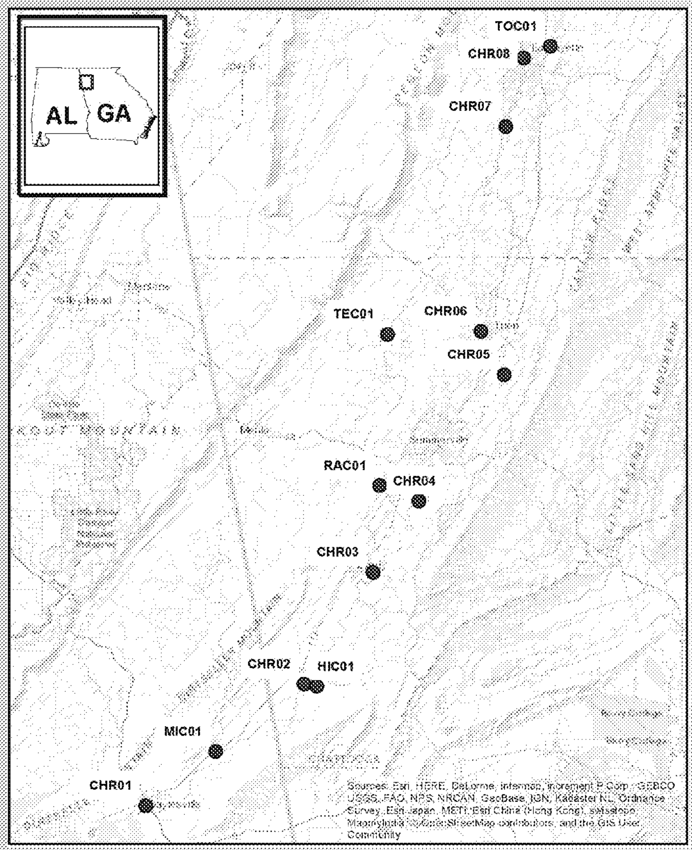
6 SW samples had results above the LHA



Intakes, biosolids fields and SW samples above LHA

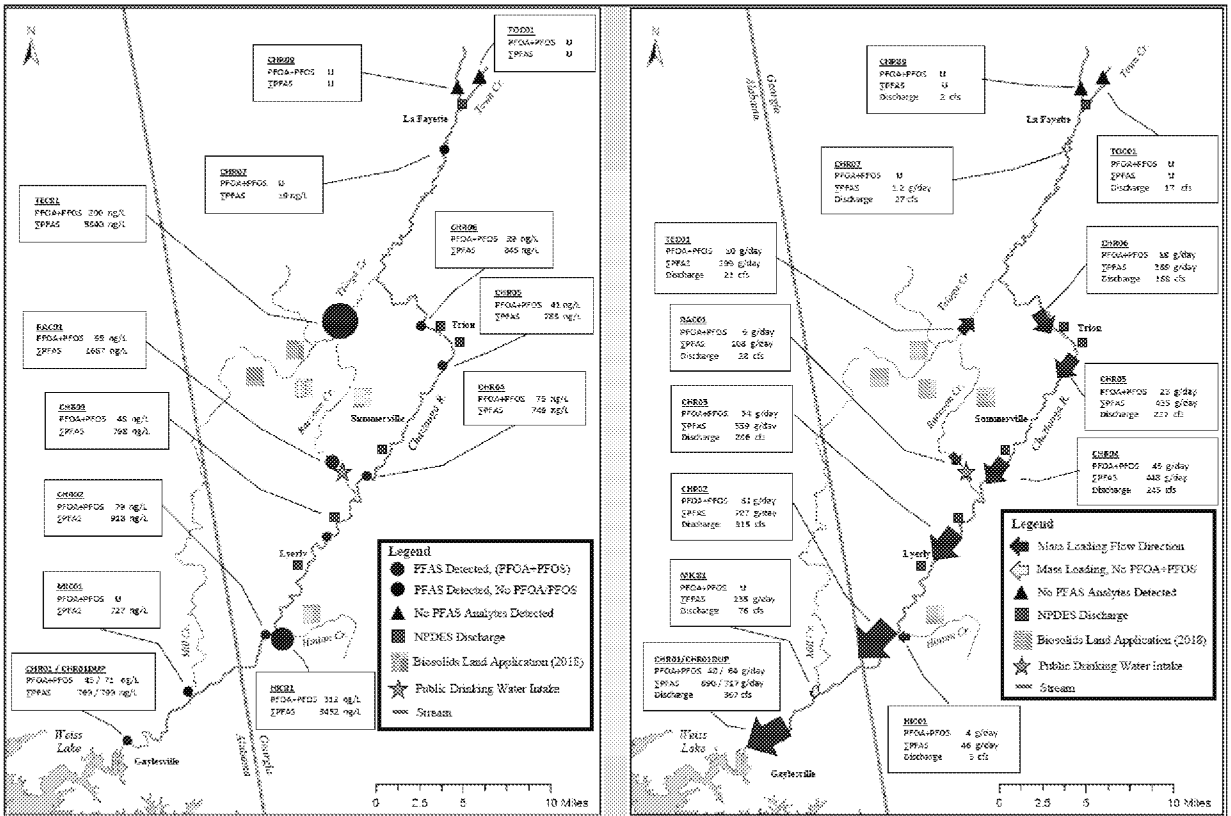
Unlike the Coosa River watershed, more biosolids fields are in the Chattooga



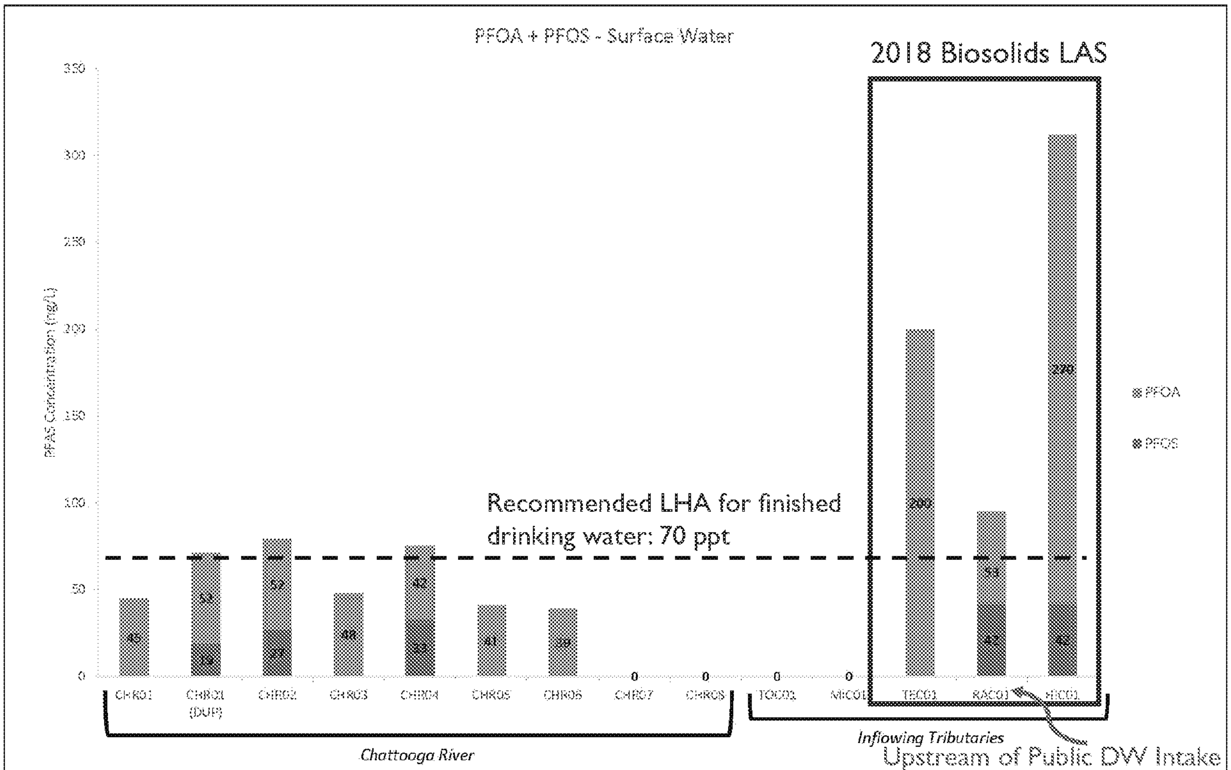
Total of 13 sites sampled for 25 PFAS Analytes:

- 8 sites on the main stem
- 3 sites on LAS* tributaries
- 2 sites from other inflowing tributaries

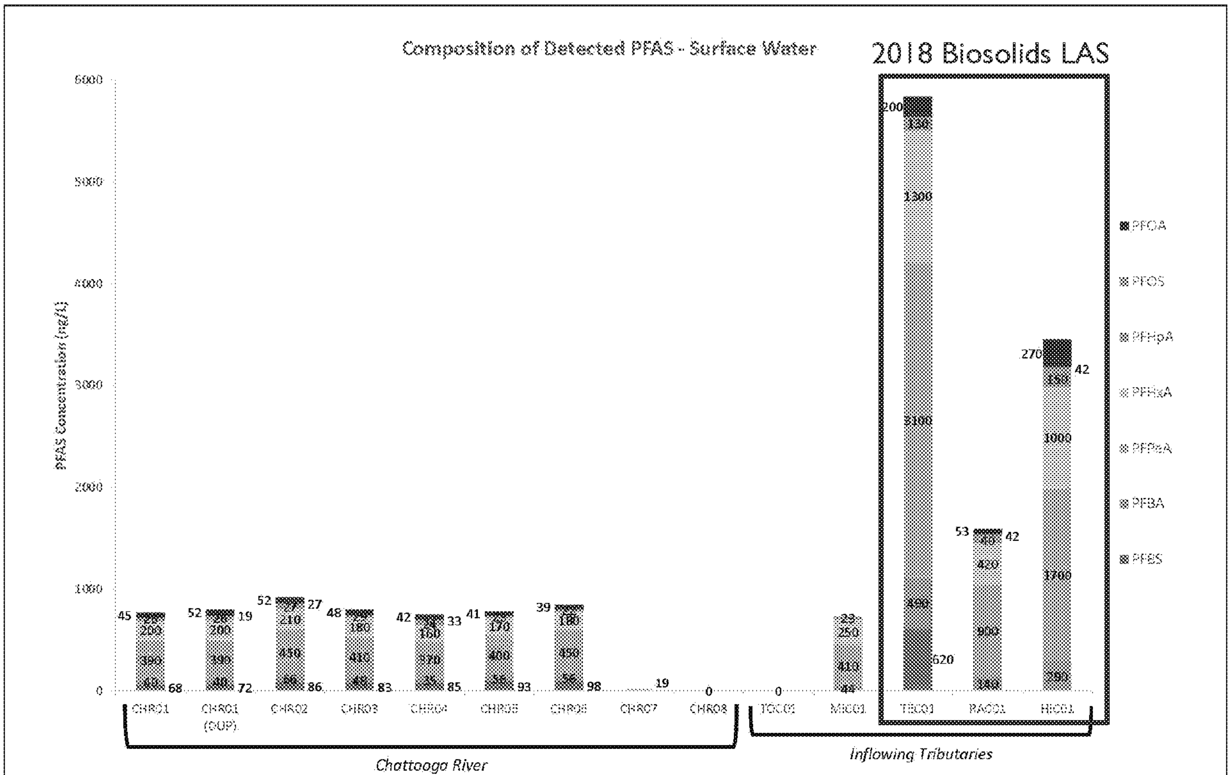
For this presentation, the term LAS refers to biosolids Land Application Sites



- No PFOA+PFOS detected in SW from headwaters
- LAS tributaries ranged from 95 – 312 ng/L for PFOA + PFOS concentrations
- Mass loading increased moving downstream
- LAS tributaries contributed between 31 – 97% of the relative ∑PFAS detected downstream



- Surface water sample results represent a snapshot in time
- TEC01, RAC01, & HIC01 are tributary sites impacted by biosolids land application
- Public drinking water intake for City of Summerville located just upstream of station RAC01
- Surface waters dominated by short-chain PFCAs



- Surface water sample results represent a snapshot in time
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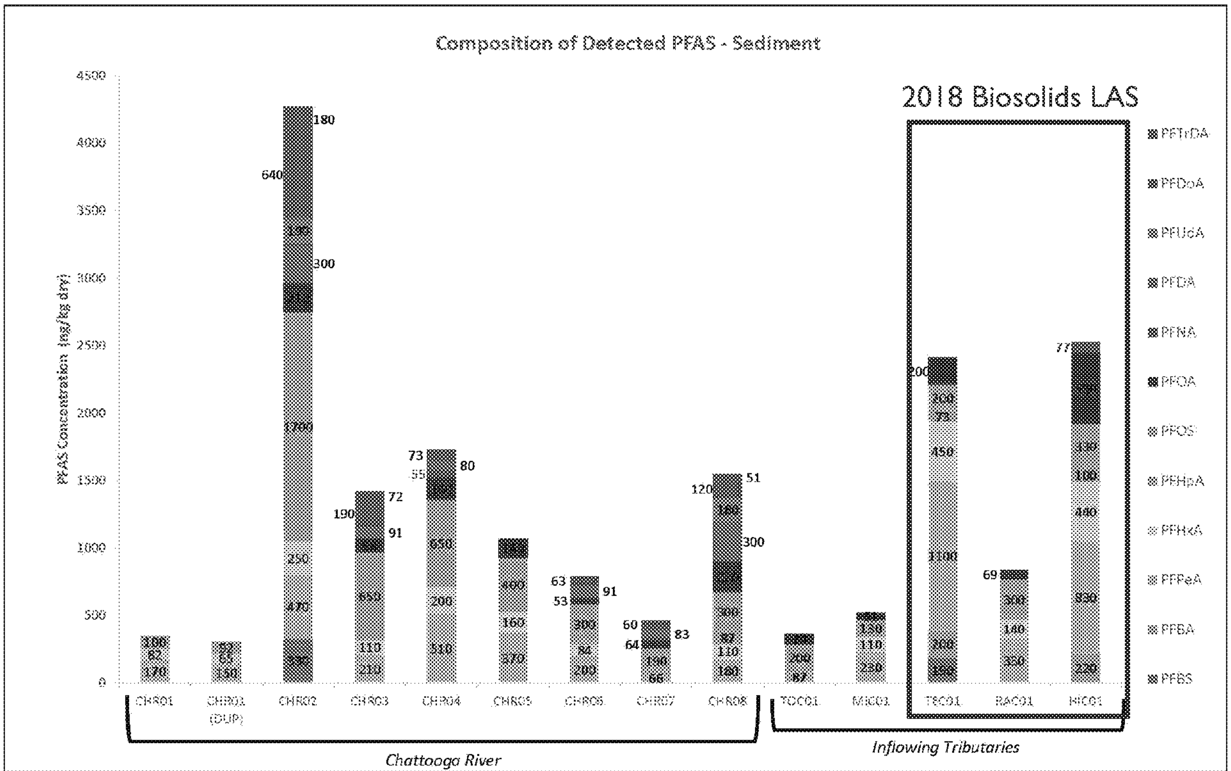

- Sediment sample results represent integration over time & are dependent on site conditions, such as the amount of total organic carbon (TOC) present
- TEC01, RAC01, & HIC01 are tributary sites impacted by biosolids land application
- Sediments generally dominated by short-chain PFCAs

Characterization of Ambient PFAS in the Chattooga River Watershed

Conclusions

<u>Sediment Sampling Results:</u> 12 distinct PFAS compounds detected, <u>majority</u> of samples dominated by short-chain PFCAs

<u>Surface Water Sampling Results:</u> 7 distinct PFAS compounds detected, <u>all</u> samples dominated by short-chain PFCAs

- No PFAS detected in surface water samples from headwaters
- Significant contribution of ∑PFAS & combined PFOA+PFOS inputs from tributaries with active biosolids land application sites
- Short-chain PFCAs (C5&C6) dominate both SW & SD, suggesting a local source of short-chain PFCAs &/or their precursors within the watershed
- Transport of both SW & SD contaminated with PFAS from the Chattooga River Watershed → Weiss Lake